CLAIMS

1. An image-capturing apparatus comprising:

an image-capturing optical unit which reflects or transmits a light beam from an object;

an image-capturing controller for controlling the image-capturing optical unit to allow the image-capturing optical unit to operate in a periodical manner;

an image-capturing driver for driving the image-capturing optical unit based on the control operation by the image-capturing controller; and

at least one image-capturing unit which receives the light beam from the object entering via the image-capturing optical unit operating periodically so as to capture an image of the object.

2. The image-capturing apparatus according to Claim 1, wherein the image-capturing optical unit changes an optical path of the light beam from the object.

3. The image-capturing apparatus according to Claim 1, wherein the image-capturing optical unit comprises a prismatic-mirror assembly in which a plurality of prismatic mirrors are arrayed, and

wherein the image-capturing controller rotates the prismatic mirrors in the prismatic-mirror assembly in phase

with one another at a constant angular rate such that each prismatic mirror rotates about a rotary axis extending between central points of two end surfaces of the prismatic mirror.

4. The image-capturing apparatus according to Claim 3, wherein the prismatic mirrors in the prismatic-mirror assembly are arrayed parallel to one another in the same plane while the rotary axis of each prismatic mirror extends in the vertical direction, and

wherein the prismatic mirrors reflect beam components of the light beam from the object entering from various directions towards said at least one image-capturing unit.

5. The image-capturing apparatus according to Claim 1, wherein the image-capturing optical unit comprises a lenticular-lens assembly in which a plurality of semi-cylindrical lenses are arrayed, and

wherein the image-capturing controller controls the lenticular-lens assembly in a periodical manner such that the semi-cylindrical lenses in the lenticular-lens assembly are shifted periodically.

6. The image-capturing apparatus according to Claim 5, wherein the image-capturing optical unit further comprises

slits through which the light beam emitted from the object and transmitted through the semi-cylindrical lenses passes.

7. The image-capturing apparatus according to Claim 5, wherein the semi-cylindrical lenses in the lenticular-lens assembly are arrayed parallel to one another in the same plane while each semi-cylindrical lens extends longitudinally in the vertical direction, and

wherein the image-capturing controller oscillates the lenticular-lens assembly horizontally in a periodical manner.

8. The image-capturing apparatus according to Claim 5, wherein the lenticular-lens assembly is circular such that the semi-cylindrical lenses are arrayed to form a circle, each semi-cylindrical lens extending longitudinally along the radius of the circle, and

wherein the image-capturing controller rotates the circular lenticular-lens assembly at a predetermined period.

9. The image-capturing apparatus according to Claim 5, wherein the lenticular-lens assembly is cylindrical such that the semi-cylindrical lenses are arrayed to form a cylinder, each semi-cylindrical lens extending longitudinally in the vertical direction, and

wherein the image-capturing controller rotates the

cylindrical lenticular-lens assembly at a predetermined period.

10. The image-capturing apparatus according to Claim 9, wherein the object is disposed outside the cylindrical lenticular-lens assembly, and

wherein said at least one image-capturing unit is disposed inside the cylindrical lenticular-lens assembly so as to receive the light beam from the object via the lenticular-lens assembly.

11. The image-capturing apparatus according to Claim 9, wherein the object is disposed inside the cylindrical lenticular-lens assembly, and

wherein said at least one image-capturing unit is disposed outside the cylindrical lenticular-lens assembly so as to receive the light beam from the object via the lenticular-lens assembly.

12. The image-capturing apparatus according to Claim 11, wherein said at least one image-capturing unit comprises a plurality of image-capturing units,

wherein each of the image-capturing units is disposed outside the cylindrical lenticular-lens assembly so as to receive the light beam from the object via the lenticular-

lens assembly.

13. The image-capturing apparatus according to Claim 11, further comprising a reflective unit for reflecting the light beam from the object traveling through the lenticular-lens assembly towards said at least one image-capturing unit.

14. The image-capturing apparatus according to Claim 1, further comprising an output unit for outputting drive data and image data of the object, the drive data indicating the timing for driving the image-capturing optical unit by the image-capturing driver, the image data being obtained when said at least one image-capturing unit captures the image of the object.

15. The image-capturing apparatus according to Claim 1, further comprising a display device for displaying the image of the object captured by said at least one image-capturing unit.

16. The image-capturing apparatus according to Claim 15, wherein the display device comprises:

at least one light-emitting unit for emitting a light beam corresponding to the image of the object captured by said at least one image-capturing unit;

a display optical unit for reflecting or transmitting the light beam emitted from said at least one light-emitting unit;

a display controller for controlling the display optical unit to allow the display optical unit to operate in a periodical manner; and

a display driver for driving the display optical unit based on the control operation by the display controller.

17. The image-capturing apparatus according to Claim 16, wherein the display device further comprises a diffuser which diffuses the light beam corresponding to the image of the object received via the display optical unit, which operates in a periodical manner, so as to display the image of the object.

18. The image-capturing apparatus according to Claim 16, wherein the image-capturing optical unit comprises a first prismatic-mirror assembly in which a plurality of prismatic mirrors are arrayed,

wherein the image-capturing controller rotates the prismatic mirrors in the first prismatic-mirror assembly in phase with one another at a constant angular rate such that each prismatic mirror rotates about a rotary axis extending between central points of two end surfaces of the prismatic

mirror,

wherein the display optical unit comprises a second prismatic-mirror assembly having the same structure as the first prismatic-mirror assembly, and

wherein the display controller rotates the prismatic mirrors in the second prismatic-mirror assembly in phase with the prismatic mirrors in the first prismatic-mirror assembly at a constant angular rate such that each prismatic mirror in the second prismatic-mirror assembly rotates about a rotary axis extending between central points of two end surfaces of the prismatic mirror in the second prismatic-mirror assembly.

19. The image-capturing apparatus according to Claim 18, wherein the prismatic mirrors in each of the first and second prismatic-mirror assemblies are arrayed parallel to one another in the same plane while the rotary axis of each prismatic mirror extends in the vertical direction,

wherein the prismatic mirrors in the first prismatic-mirror assembly reflect beam components of the light beam from the object entering from various directions towards said at least one image-capturing unit, and

wherein the prismatic mirrors in the second prismatic-mirror assembly reflect the light beam emitted from said at least one light-emitting unit.

20. The image-capturing apparatus according to Claim 16, wherein the image-capturing optical unit comprises a first lenticular-lens assembly in which a plurality of semi-cylindrical lenses are arrayed,

wherein the image-capturing controller controls the first lenticular-lens assembly in a periodical manner such that the semi-cylindrical lenses in the first lenticular-lens assembly are shifted periodically,

wherein the display optical unit comprises a second lenticular-lens assembly having the same structure as the first lenticular-lens assembly, and

wherein the display controller controls the second lenticular-lens assembly in a periodical manner such that the semi-cylindrical lenses in the second lenticular-lens assembly are shifted periodically in phase with the corresponding semi-cylindrical lenses in the first lenticular-lens assembly.

21. The image-capturing apparatus according to Claim 20, wherein the display optical unit further comprises slits through which the light beam emitted from said at least one light-emitting unit and transmitted through the semi-cylindrical lenses in the second lenticular-lens assembly passes.

22. The image-capturing apparatus according to Claim 20, wherein the semi-cylindrical lenses in each of the first and second lenticular-lens assemblies are arrayed parallel to one another in the same plane while each semi-cylindrical lens extends longitudinally in the vertical direction,

wherein the image-capturing controller periodically oscillates the first lenticular-lens assembly in the horizontal direction, and

wherein the display controller horizontally oscillates the second lenticular-lens assembly in phase with the first lenticular-lens assembly.

23. The image-capturing apparatus according to Claim 20, wherein each of the first and second lenticular-lens assemblies is circular such that the semi-cylindrical lenses of the corresponding lenticular-lens assembly are arrayed to form a circle, each semi-cylindrical lens extending longitudinally along the radius of the circle,

wherein the image-capturing controller rotates the first circular lenticular-lens assembly at a predetermined period, and

wherein the display controller rotates the second circular lenticular-lens assembly at the same period of rotation as the first lenticular-lens assembly.

24. The image-capturing apparatus according to Claim 20, wherein each of the first and second lenticular-lens assemblies is cylindrical such that the semi-cylindrical lenses of the corresponding lenticular-lens assembly are arrayed to form a cylinder, each semi-cylindrical lens extending longitudinally in the vertical direction,

wherein the image-capturing controller rotates the first cylindrical lenticular-lens assembly at a predetermined period, and

wherein the display controller rotates the second cylindrical lenticular-lens assembly at the same period of rotation as the first lenticular-lens assembly.

25. The image-capturing apparatus according to Claim 24, wherein the object is disposed outside the first cylindrical lenticular-lens assembly,

wherein said at least one image-capturing unit is disposed inside the first cylindrical lenticular-lens assembly so as to receive the light beam from the object via the first lenticular-lens assembly, and

wherein said at least one light-emitting unit is disposed inside the second cylindrical lenticular-lens assembly so as to emit the light beam corresponding to the image of the object.

26. The image-capturing apparatus according to Claim 24, wherein the object is disposed inside the first cylindrical lenticular-lens assembly,

wherein said at least one image-capturing unit is disposed outside the first cylindrical lenticular-lens assembly so as to receive the light beam from the object via the first lenticular-lens assembly, and

wherein said at least one light-emitting unit is disposed inside the second cylindrical lenticular-lens assembly so as to emit the light beam corresponding to the image of the object.

27. The image-capturing apparatus according to Claim 26, wherein said at least one image-capturing unit comprises a plurality of image-capturing units,

wherein each of the image-capturing units is disposed outside the first cylindrical lenticular-lens assembly so as to receive the light beam from the object via the first lenticular-lens assembly,

wherein said at least one light-emitting unit included in the display device comprises a plurality of light-emitting units, the number of the light-emitting units being equivalent to the number of the image-capturing units provided, and

wherein each of the light-emitting units is disposed inside the second cylindrical lenticular-lens assembly so as to emit the light beam corresponding to the image of the object captured by the corresponding one of the image-capturing units.

28. The image-capturing apparatus according to Claim 26, further comprising a reflective unit for reflecting the light beam from the object traveling through the first lenticular-lens assembly towards said at least one image-capturing unit.

29. The image-capturing apparatus according to Claim 16, further comprising an output unit for outputting drive data and image data of the object, the drive data indicating the timing for driving the image-capturing optical unit by the image-capturing driver, the image data being obtained when said at least one image-capturing unit captures the image of the object,

wherein the display controller allows the display driver to drive the display optical unit based on the drive data.

30. The image-capturing apparatus according to Claim 16, further comprising an image detector for detecting the image

of the object captured by said at least one image-capturing unit when the image-capturing optical unit reflects the light beam from the object by 180° or directly transmits the light beam from the object,

wherein the display controller controls the display driver based on the detection result of the image of the object by the image detector.

31. A method for capturing an image of an object comprising the steps of:

controlling an image-capturing optical unit, which reflects or transmits a light beam from the object, so as to allow the image-capturing optical unit to operate in a periodical manner;

driving the image-capturing optical unit based on the controlling step; and

receiving the light beam from the object via the image-capturing optical unit operating periodically so as to capture the image of the object.

32. A display apparatus for displaying an image of an object, comprising:

at least one light-emitting unit for emitting a light beam corresponding to the image of the object;

a display optical unit for reflecting or transmitting

the light beam emitted from said at least one light-emitting unit;

a display controller for controlling the display optical unit to allow the display optical unit to operate in a periodical manner; and

a display driver for driving the display optical unit based on the control operation by the display controller.

33. The display apparatus according to Claim 32, wherein the display optical unit changes an optical path of the light beam emitted from said at least one light-emitting unit.

34. The display apparatus according to Claim 32, wherein the image of the object is equivalent to an image of the object captured by an image-capturing device.

35. The display apparatus according to Claim 34, further comprising a diffuser which diffuses the light beam corresponding to the image of the object received via the display optical unit, which operates in a periodical manner, so as to display the image of the object.

36. The display apparatus according to Claim 34, wherein the image-capturing device comprises:

an image-capturing optical unit which reflects or transmits the light beam from the object;

an image-capturing controller for controlling the image-capturing optical unit to allow the image-capturing optical unit to operate in a periodical manner;

an image-capturing driver for driving the image-capturing optical unit based on the control operation by the image-capturing controller; and

at least one image-capturing unit which receives the light beam from the object entering via the image-capturing optical unit operating periodically so as to capture the image of the object,

wherein the display controller controls the display optical unit so as to allow the display optical unit to operate in the same periodical manner as the image-capturing optical unit.

37. The display apparatus according to Claim 36, wherein the image-capturing optical unit comprises a first prismatic-mirror assembly in which a plurality of prismatic mirrors are arrayed,

wherein the image-capturing controller rotates the prismatic mirrors in the first prismatic-mirror assembly in phase with one another at a constant angular rate such that each prismatic mirror rotates about a rotary axis extending

between central points of two end surfaces of the prismatic mirror,

wherein the display optical unit comprises a second prismatic-mirror assembly having the same structure as the first prismatic-mirror assembly, and

wherein the display controller rotates the prismatic mirrors in the second prismatic-mirror assembly in phase with the prismatic mirrors in the first prismatic-mirror assembly at a constant angular rate such that each prismatic mirror in the second prismatic-mirror assembly rotates about a rotary axis extending between central points of two end surfaces of the prismatic mirror in the second prismatic-mirror assembly.

38. The display apparatus according to Claim 37, wherein the prismatic mirrors in each of the first and second prismatic-mirror assemblies are arrayed parallel to one another in the same plane while the rotary axis of each prismatic mirror extends in the vertical direction,

wherein the prismatic mirrors in the first prismatic-mirror assembly reflect beam components of the light beam from the object entering from various directions towards said at least one image-capturing unit, and

wherein the prismatic mirrors in the second prismatic-mirror assembly reflect the light beam emitted from said at

least one light-emitting unit.

39. The display apparatus according to Claim 36, wherein the image-capturing optical unit comprises a first lenticular-lens assembly in which a plurality of semi-cylindrical lenses are arrayed,

wherein the image-capturing controller controls the first lenticular-lens assembly in a periodical manner such that the semi-cylindrical lenses in the first lenticular-lens assembly are shifted periodically,

wherein the display optical unit comprises a second lenticular-lens assembly having the same structure as the first lenticular-lens assembly, and

wherein the display controller controls the second lenticular-lens assembly in a periodical manner such that the semi-cylindrical lenses in the second lenticular-lens assembly are shifted periodically in phase with the corresponding semi-cylindrical lenses in the first lenticular-lens assembly.

40. The display apparatus according to Claim 39, wherein the display optical unit further comprises slits through which the light beam emitted from said at least one light-emitting unit and transmitted through the semi-cylindrical lenses in the second lenticular-lens assembly passes.

41. The display apparatus according to Claim 39, wherein the semi-cylindrical lenses in each of the first and second lenticular-lens assemblies are arrayed parallel to one another in the same plane while each semi-cylindrical lens extends longitudinally in the vertical direction,

wherein the image-capturing controller periodically oscillates the first lenticular-lens assembly in the horizontal direction, and

wherein the display controller horizontally oscillates the second lenticular-lens assembly in phase with the first lenticular-lens assembly.

42. The display apparatus according to Claim 39, wherein each of the first and second lenticular-lens assemblies is circular such that the semi-cylindrical lenses of the corresponding lenticular-lens assembly are arrayed to form a circle, each semi-cylindrical lens extending longitudinally along the radius of the circle,

wherein the image-capturing controller rotates the first circular lenticular-lens assembly at a predetermined period, and

wherein the display controller rotates the second circular lenticular-lens assembly at the same period of rotation as the first lenticular-lens assembly.

43. The display apparatus according to Claim 39, wherein each of the first and second lenticular-lens assemblies is cylindrical such that the semi-cylindrical lenses of the corresponding lenticular-lens assembly are arrayed to form a cylinder, each semi-cylindrical lens extending longitudinally in the vertical direction,

wherein the image-capturing controller rotates the first cylindrical lenticular-lens assembly at a predetermined period, and

wherein the display controller rotates the second cylindrical lenticular-lens assembly at the same period of rotation as the first lenticular-lens assembly.

44. The display apparatus according to Claim 43, wherein the object is disposed outside the first cylindrical lenticular-lens assembly,

wherein said at least one image-capturing unit is disposed inside the first cylindrical lenticular-lens assembly so as to receive the light beam from the object via the first lenticular-lens assembly, and

wherein said at least one light-emitting unit is disposed inside the second cylindrical lenticular-lens assembly so as to emit the light beam corresponding to the image of the object.

45. The display apparatus according to Claim 43, wherein the object is disposed inside the first cylindrical lenticular-lens assembly,

wherein said at least one image-capturing unit is disposed outside the first cylindrical lenticular-lens assembly so as to receive the light beam from the object via the first lenticular-lens assembly, and

wherein said at least one light-emitting unit is disposed inside the second cylindrical lenticular-lens assembly so as to emit the light beam corresponding to the image of the object.

46. The display apparatus according to Claim 45, wherein said at least one image-capturing unit included in the image-capturing device comprises a plurality of image-capturing units,

wherein each of the image-capturing units is disposed outside the first cylindrical lenticular-lens assembly so as to receive the light beam from the object via the first lenticular-lens assembly,

wherein said at least one light-emitting unit comprises a plurality of light-emitting units, the number of the light-emitting units being equivalent to the number of the image-capturing units provided, and

wherein each of the light-emitting units is disposed inside the second cylindrical lenticular-lens assembly so as to emit the light beam corresponding to the image of the object captured by the corresponding one of the image-capturing units.

47. The display apparatus according to Claim 36, further comprising an output unit for outputting drive data and image data of the object, the drive data indicating the timing for driving the image-capturing optical unit by the image-capturing driver, the image data being obtained when said at least one image-capturing unit captures the image of the object,

wherein the display controller allows the display driver to drive the display optical unit based on the drive data.

48. The display apparatus according to Claim 36, further comprising an image detector for detecting the image of the object captured by said at least one image-capturing unit when the image-capturing optical unit reflects the light beam from the object by 180° or directly transmits the light beam from the object,

wherein the display controller controls the display driver based on the detection result of the image of the

object by the image detector.

49. A method for displaying an image of an object, comprising the steps of:

controlling a display optical unit, which reflects or transmits a light beam corresponding to the image of the object, so as to allow the display optical unit to operate in a periodical manner; and

driving the display optical unit based on the controlling step.